DESCRIPTION

Cable Management and Contact Monitoring System

BACKGROUND ART

Retractable conductors are well known in the prior art. For instance electrical cords for portable lighting and extension cords are commonly used in a multitude of settings from home uses to commercial uses such as those of automotive mechanics. Also, the use of contact detection failure devices is also known in the prior art by use of indicators of various types both visual and audible.

While the use of these devices in the prior art are common for two to three conductor extension cord types of uses, the prior art is devoid of the application of these devises to such uses as computers in various settings, fetal monitors, defibrillators, heart monitors and therapeutic electrical stimulation machines for use in clinical settings. The current technology for conductive connectors of these devices to their respective output devices is most generally conductive wires or cables with functional connectors on each end to connect the devices. The consequences of the use of these types of connectors results in a tangle of cables as in the use of computers with no cable specific failure detection means.

Also the prior art usage of conductive connectors and cables in the use of devices such as fetal monitors, defibrillators, heart monitors and therapeutic electrical stimulation machines in a clinical setting results in these connectors and cables being moved, used and stored frequently which most often results in the tangling and crimping of these cables causing frequent pre-mature failure as the cable breaks or

wears out. The prior art cables in these clinical settings also do not utilize a cable failure detection means.

It is well known that the cables and cords associated with modern medical equipment can be difficult to manage in a clinical setting. The cables become tangled and draped in high activity areas leading to interference with the clinician's actions or the patient's comfort. Invariably cables are stressed and consequently are prone to premature failure. Cable failures will result in an operational fault, which is generally detected by the patient. This fault could be due to any one of a number of components including the cable. Any troubleshooting aid will help the clinician rectify the problem and resume treating the patient.

There are many passive means of managing cables including cableways and various ties but none facilitate the level of activity needed in a clinical environment. Thus it is the objective of the present invention to provide an active system capable of satisfying the demanding cable management requirements such as in a clinical environment and that provides some troubleshooting support in the event of a cable failure.

While each of these prior art cable management and contact monitoring systems fulfill their respective particular objectives and requirements, and are most likely quite functional for their intended purposes, it will be noticed that none of the prior art cited disclose an apparatus and/or method that is portable, rugged, and lightweight and that can be used for computers in various settings, fetal monitors, defibrilators, heart monitors and therapeutic electrical stimulation machines in a clinical setting to meet the operational requirements of the user. Also, the prior art does not provide the user with a means to directly detect conductor cable failure.

As such, there apparently still exists the need for a new and improved cable management and contact monitoring system to maximize the conductor cable life-span by storing the cable in a retracted position while allowing monitoring of the cable's integrity during its use.

In this respect, the present invention disclosed herein substantially corrects

these problems and fulfills the need for such a device.

DISCLOSURE OF THE INVENTION

In view of the foregoing limitations inherent in the known types of cable management and contact monitoring systems now present in the prior art, the present invention provides an apparatus that has been designed to provide the following features for a user:

- a cable management and contact monitoring system that can be interfaced with a wide range of devices such as computers and computer input or output devices, fetal monitors, defibrilators, heart monitors and therapeutic electrical stimulation machines in a clinical setting;
- cable retraction onto a cable drum for easy cable storage;
- stored cable is protected from excessive wear and crimping while not in use;
- provides any easy to view LED indicator or audible signal (or combination thereof) that indicates the presence or absence of contact between the device and its intended connection by the invention such as another computer, a printer, monitor or other computer input or output device, or in the case of a medical application to a patient; and
- manual or automatic braking of the cable retraction mechanism.

The present invention in its preferred embodiment is a self-contained system comprised of a housing, slip-ring connector, a spring actuated cable reel with manual stop and an indicator light circuit. The system will store cable on the reel when not in use. To operate the invention the operator will pull the braking mechanism, draw out the cable end out to the desired length and release the brake. A green indicator light will show indicate normal operation. A yellow lamp will light to indicate an open, or failure, in the electrode circuit.

These features are improvements which are patently distinct over similar devices and methods which may already be patented or commercially available. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide a field designed apparatus and method of use that incorporates the present invention. There are many additional novel features directed to solving problems not addressed in the prior art.

To attain this the present invention generally comprises four main components: 1) the core assembly; 2) the rotor assembly; 3) the brake assembly; and 4) the input cord assembly.

These together with other objects of the invention, along with the various features of novelty which characterize the invention, will be pointed out with particularity in the claims which are annexed hereto and forming a part of this patent application. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of the four wire cable embodiment of the invention including references to various component assemblies.

FIG. 2 is an exploded perspective view of the core assembly of the four wire cable embodiment of the invention.

FIG. 3 is an exploded perspective view of the rotor assembly of the four wire cable embodiment of the invention.

FIG. 4 is an exploded perspective view of the manual brake assembly of the four wire cable embodiment of the invention.

FIG. 5. is a perspective view of the input cord assembly of the four wire cable embodiment of the invention.

BEST MODES FOR CARRYING OUT THE INVENTION

I. PREFERRED EMBODIMENTS

With reference now to the drawings, and in particular to **Figures 1-5** thereof,

a new and novel apparatus for a four wire cable embodiment cable management and contact monitoring system embodying the principles and concepts of the present invention is depicted in these drawings as comprising four major components, the core assembly, the rotor assembly, the brake assembly and the input cord assembly and are generally depicted with each assembly's respective component parts in **Fig. 2**, **Fig. 3, Fig. 4 and Fig. 5** respectively.

General Description of Reference Numerals in the Description and Drawings

Any actual dimensions listed are those of the preferred embodiment. Actual dimensions or exact hardware details and means may vary in a final product or most preferred embodiment and should be considered means for so as not to narrow the claims of the patent.

List and Description of component parts of the invention:

(1) Core Assembly
(2) Rotor Assembly
(3) Box Base
(4) Box Top
(5) Input Cord Assembly
(6) Compression Spring
(7) LED Indicators
(8) "Skintop" PG7 Gland
(9) Neoprene Equipment Foot
(10) Pan Head Machine Screws
(11) SBHCS Screw
(12) M6 Hex Jam Nut
(21) Spindle
(22) Base Standoff
(23) Two-Sided Adhesive Tape
(24) Contactor Stator
(31) Cable Drum
(32) Drum Cap
(33) Torsion Spring
(34) Contactor Rotor Assembly
(35) Rotor Backing Plate
(36) Sintered Bronze Bushing
(37) 4-Conductor Input Cable End
(38) Two-Sided Adhesive Tape

(39A) One Pin Connector - Red "2"
(39B) One Pin Connector - Red "1"
(39C) One Pin Connector - Black "2"
(39D) One Pin Connector - Black "1"
(43) Brake Pin
(44) Bushing
(45) Short Compression Spring
(46) Flat Washer
(47) External Retaining Ring
(51) 4-Conductor Input Cable
(52) 4 Pin DIN Connector

Detailed Description of the Preferred Embodiments:

The four wire cable embodiment of the invention as shown in **Figure 1** consists of a Box Top **4** and Box Base **3**, which provides support for all assemblies and components. Discrete components include the SBHCS Screw **11**, LED Indicator **7** which is functionally connected to the Contactor Stator **24**, four Neoprene Equipment Foot **9**, Compression Spring **6**, and 'Skintop' PG7 Gland **8**. The individual assemblies include the Core Assembly **1** (further exploded into a perspective view of component parts in Figure 2), the Rotor Assembly **2** (further exploded into a perspective view of component parts in Figure 3), the Brake Assembly of which the Brake Pin **43** is shown in **Figure 1** (an exploded perspective view of component parts of which is depicted in Figure 4), and the Input Cord Assembly **5** (a perspective view of component parts of which is depicted in Figure 5).

The SBHCS Screw **11** secures the Core Assembly **1** to the Box Base **3**. The LED Indicator(s) **7** indicate normal operation and a poor electrode, electronic or electrical connection. A poor connection is indicated by the LED Indicator(s) **7** when a higher than normal resistance is detected by the LED Indicator(s) **7** internal microprocessor and electrical current sensors across the electrodes, electronic or electrical connections (the electrodes, electronic or electrical connections are not shown but are connected while in use to a One Pin Connector - Red "2" **39A,** a One Pin Connector - Red "1" **39B**, a One Pin Connector - Black "2" **39C**, and a One Pin

Connector - Black "1" **39D** and are also placed in conductive contact with user defined devices or locations for user defined purposes such as with computers, fetal monitors, defibrilators, heart monitors and therapeutic electrical stimulation machines). A poor connection situation that illuminates the LED Indicator(s) **7** would indicate a poor connection as opposed to an open circuit, which would indicate a broken Input Cord Assembly **5** or other problem with the user selected device (a user selected device requiring four conductive leads may be connected to the invention by the 4 Pin DIN Connector **52** of the Input Cord Assembly **5** and would provide the user conduction through the 4 Conductor Cable **37** to another user defined device or patient as in a clinical medical application). In another embodiment the LED Indicator(s) **7** may be replaced with an audible signaling device or used in combination therewith.

The four Neoprene Equipment Foot **9** provide a convenient and stable foundation for the invention. In another embodiment the Neoprene Equipment Foot **9** may be replaced with a Velcro® Strip, a Two-sided adhesive tape, or other attachment means to secure the device as the user may require.

The Compression Spring **6** depicted in **Figure 1** ensures good conductive contact between the Contactor Rotor Assembly **34** and Contactor Stator **24** by providing a small preload force between the conductors thereof by exerting spring tension between the Box Top **4** and the Drum Cap **32**. A secondary function of the Compression Spring **6** is to provide a small amount of drag between the Core Assembly **1** and the Rotor Assembly **2**. This prevents the 4-Conductor Cable **37** from retracting too quickly. The 'Skintop®' PG7 Gland **8** is a bulkhead fitting that reduces stress and strain on the 4-Conductor Input Cable **51** if the Input Cord Assembly **5** is pulled.

As depicted in **Figure 2** the Core Assembly **1** is comprised of the Spindle **21**, the Base Standoff **22**, Two-Sided Adhesive Tape **23** and a Contactor Stator **24**. The Spindle **21** provides a central pivot around which all rotary motion occurs and is slotted to accept and secure the inside end of the Torsion Spring **33**. There is a threaded hole in the bottom of the Spindle **21** to accept the SBHCS Screw **11**, which

secures the Core Assembly **1** to the Box Base **3**.

The Base Standoff **22** positions the Contactor Stator **24** at the correct height to make contact with the Contactor Rotor Assembly **34** and provides a rigid flat platform on which to mount the Contactor Stator **24**. The Two-sided Adhesive Tape **23** secures the Contactor Stator **24** to the Base Standoff **22**.

The conductors on the Input Cord Assembly **5** are soldered to solder pads on the Contactor Stator **24**. The Contactor Stator **24** thereby provides a conductive path between the Input Cord Assembly **5** and the Contactor Rotor Assembly **34**.

As depicted in **Figure 3** the Rotor Assembly **2** is comprised of a Cable Drum **31**, a Drum Cap **32**, a Torsion Spring **33**, the Contactor Rotor Assembly **34**, a Rotor Backing Plate **35**, a Sintered Bronze Bushing **36**, a Four Conductor Cable **37**, a Two Sided Adhesive Tape **38** and a One Pin Connector - Red "2" **39A,** a One Pin Connector - Red "1" **39B**, a One Pin Connector - Black "2" **39C**, and a One Pin Connector - Black "1" **39D**. The Cable Drum **31** provides storage volume for the retracted Four Conductor Cable **37**.

The Drum Cap **32** contains the Torsion Spring **33**. The Torsion Spring **33** provides retraction torque to the Cable Drum **31**. The inside end of the Torsion Spring **33** is secured in the slot on the Spindle **21**. The outside end of the Torsion Spring **33** is secured to the Cable Drum **31**. The torsion of the Torsion Spring **33** is increased as the Four Conductor Cable **37** is withdrawn.

The conductors of the Four Conductor Cable **37** are soldered to the solder pads on the Conductor Rotor Assembly **34**. The Contactor Rotor Assembly **34** thereby provides a conductive path between the Four Conductor Cable **37** and the Conductor Stator **24**. The Rotor Backing Plate **35** provides a flat and secure mounting surface for the Contactor Rotor Assembly **34**.

The Sintered Bronze Bushing **36** allows smooth rotation of the Cable Drum **31** around the Spindle **21**. The Sintered Bronze Bushing **36** is press fit into the Cable Drum **31**. The Four Conductor Cable **37** provides a conductive path from the Contactor Rotor Assembly **34** to the One Pin Connectors **39A, 39B, 39C, 39D**. Two-

sided Adhesive Tape **38** is used to secure the Contactor Rotor Assembly **34** to the Rotor Backing Plate **35**.

In other various embodiments the One Pin Connectors **39A, 39B, 39C, 39D** provide a conductive path between the Four Conductor Cable **37** and the user selected device(s) such as computer input or output devices, electrodes for fetal monitors, defibrillator paddles, electrodes for heart monitors and electrodes for therapeutic electrical stimulation machines in a clinical setting. In these various embodiments the conductive pathway may be comprised of one or more conductors depending upon the needs of the user. In these other embodiments the One Pin Connectors **39A, 39B, 39C, 39D** may be replaced with USB computer connections, parallel or serial port connections, telephone jacks, Ethernet connections or standard electrical cords and electrical plugs. In these other embodiments where the conductive pathway involves one or more conductors the Input Cord Assembly **5**, the Contactor Stator **24,** the Contactor Rotor Assembly **34,** and the 4-Conductor Cable **37** would each have at least as many conductors as required by the user selected input and output device(s) all of which are functionally connected as described above in the preferred embodiment. The 4 Pin DIN Connector **52** of the Input Cord Assembly **5** in these other embodiments are replaced with the appropriate connector to the user selected input device such as USB computer connections, parallel or serial port connections, telephone jacks, Ethernet connections or standard electrical cords and electrical plugs.

As depicted in **Figure 4** the Brake Assembly is comprised of a Brake Pin **43**, a Bushing **44**, a Short Compression Spring **45**, a Flat Washer **46** and an External Retaining Ring **47**. The Brake Pin **43** engages ribs on the Cable Drum **31** to stop the rotation when the Brake Pin **43** is released. The Bushing **44** allows smooth linear motion of the Brake Pin **43**. The Bushing **44** is press-fit into the Box Top **4**. The Short Compression Spring **45** provides positive downward force through the Flat Washer **46** and the External Retaining Ring **47** to the Brake Pin **43** to prevent rotation of the Cable Drum **31**.

The Flat Washer **46** transmits spring force from the Short Compression Spring

45 to the External Retaining Ring **47**. The External Retaining Ring **47** in turn transmits force from the Flat Washer **46** to the Brake Pin **43**. In yet another embodiment the Brake Assembly is automatic only requiring the user to retract and detract the cable by pulling on the cable without the need of also pushing the Brake Pin **43** as in the preferred embodiment.

As depicted in **Figure 5** the Input Cord Assembly **5** of the preferred embodiment is comprised of a Four Conductor Input Cable **51** and the Four Pin DIN Connector **52**. The Four Conductor Input Cable **51** provides a conductive path from the Contactor Stator **24** to the Four Pin DIN Connector **52**. The Four Pin DIN Connector **52** provides a conductive path between the Four Conductor Cable **51** and the user selected input device(s) such as computers, fetal monitors, defibrilators, heart monitors and therapeutic electrical stimulation machines in a clinical setting. In the various other embodiments described above the Four Pin DIN Connector **52** and the Four Conductor Cable **51** may be replaced with other connectors and cables appropriate for the user selected input devices, each of which having the required connector (i.e. USB, telephone jack, extension cord plug, etc.) and the required number of conductors (i.e. wires, cables or other conductive pathway).

While my above descriptions of the invention, its parts, and operations contains many specificities, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of present embodiments thereof. Many other variations are possible, for example, other embodiments, shapes, and sizes of the device can be constructed to fit on or in a device such as computers, fetal monitors, defibrilators, heart monitors and therapeutic electrical stimulation machines. The types of connectors and numbers of conductive pathways can also be changed according to the needs of a user. Also various materials, differing user selected input and output devices, colors and configurations can be employed in the unit's design that would provide interesting embodiment differences to users including such practical designs as would, for instance conceal the unit, or apply the use to a computer and its input or output.

Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the claims and their legal equivalents as filed herewith.

Having described my invention, I claim: